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Heliport Night Parking Area Criteria Test Plan

Marvin S. Plotka
Rosanne M. Weiss

March 1989

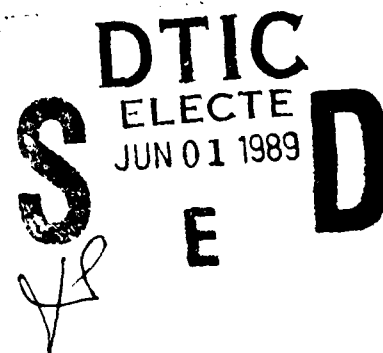
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16. Abstract <p>This flight test plan describes the methodology to examine the issue of heliport night parking surface separation criteria. Operational measures will be collected at the Federal Aviation Administration (FAA) Technical Center, Atlantic City International Airport, New Jersey, using an instrumented UH-1H helicopter.</p> <p>Flight maneuvers will be conducted at the Technical Center to identify night parking area separation criteria under various wind conditions. Wind velocity and direction data will be collected during night parking operations to determine effects at different locations around the parking area. This data will be used to create a baseline for characterizing heliport night parking area separation criteria. The test development, test equipment, data collection, data reduction, and analysis of flight data are discussed. A schedule for the completion of the associated tasks is presented.</p>			
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EXECUTIVE SUMMARY

The Airborne Systems Technology Branch, ACD-330, received a request from the Office of Rotorcraft Technology, ADS-220, to examine the issue of heliport night parking area surface separation.

Several factors prompted this activity. The current Heliport Design Advisory Circular, AC 150/5390-2, discusses separation criteria for maneuvering at heliports. These criteria, however, were not developed for night time operations. Data were also collected at the Federal Aviation Administration (FAA) Technical Center during the late fall of 1987 and early winter 1988 to aid in the development of separation criteria for other than night time conditions and recommendations were made. These recommendations, however, have been questioned in reference to their applicability to maneuvering under low ambient light conditions.

The primary objectives of the project are to collect data during night parking area maneuvers flown by subject pilots under wind conditions both with and without an obstacle in the parking area.

Observer recorded data and ground-based manually collected data will be used to aid in the development of separation criteria for night parking areas.

1. INTRODUCTION.

1.1 PURPOSE.

This test plan describes additional testing that must be conducted for the development of heliport parking area separation criteria and has the following purpose:

- a. Identify problems for investigation and define tasks for their resolution.
- b. Develop appropriate test procedures.
- c. Specify required data.
- d. Describe methods for data collection, reduction, and analysis.

1.2 BACKGROUND.

The focus of this test is on the issue of rotor tip clearance in ground maneuver areas at a heliport under low ambient lighting. This includes rotor tip clearance from ground markings and from obstructions.

The separation criteria in ground maneuver areas, as stated in the Federal Aviation Administration (FAA) Heliport Design Advisory Circular, AC 150/5390-2, has been challenged by industry.

The data collected during this test will examine night parking separations to determine whether changes to the current separation criteria can be supported. The FAA Heliport Design Advisory Circular states:

"except for helipads and helidecks located in the Final Approach and Takeoff Area (FATO) or takeoff and landing area, the parking area shall be located such that parked helicopters are clear of the approach and departure surfaces and have at least 1/3 rotor diameter but not less than 10 foot (3m) clearance from a takeoff and landing area or a fixed or movable object."

1.3 OBJECTIVES.

The primary objectives of this testing are:

- a. To determine the safe rotor tip clearances preferred by pilots when parking an aircraft near objects under night, low ambient light conditions.
- b. To determine how well pilots can judge tip clearance when asked to park a set distance from an edge marking or an object under night, low ambient light conditions.

1.4 TEST LOCATION.

All night parking area tests will be conducted at the FAA's National Concepts Development and Demonstration Heliport located at the FAA Technical Center, Atlantic City International Airport, N.J. The data reduction equipment is located at the FAA Technical Center.

2. PROBLEM/TASKS.

2.1 STATEMENT OF THE PROBLEM.

The Heliport, Taxiing, and Landing Area Criteria Test Plan (Technical Note TN87/10) describes the procedures used to examine the surface separation criteria as defined in the Heliport Design Advisory Circular. Tests were conducted at the heliport during the fall of 1987 and early winter 1988 to determine pilots' preferred rotor tip clearance when parking near objects and to measure pilot performance during parking maneuvers. However, these tests were conducted under visual flight rule (VFR) daylight conditions. Given the limitations of scotopic vision, it is possible that pilot parking separation performance and perception may deteriorate under night, low ambient light conditions. Further testing should be conducted to determine pilot performance and perception in relation to parking near lit and unlit objects and ground markings under low ambient light conditions with varied wind conditions.

2.2 TASKS.

2.2.1 Approach to Testing.

To explore the three issues, it is necessary to conduct numerous surface maneuvers. These maneuvers will consist of parking with and without an object, under varied wind conditions (see figure 1 for the heliport layout). Each subject pilot will be asked to perform a minimum of 36 parking maneuvers. For half of the maneuvers the subject pilot will be asked to park the aircraft at what he determines to be a safe distance from an object as well as from a ground mark with a headwind, a tailwind, and a crosswind. Also, the pilot will be asked to park at a predetermined set distance from the same object and the same ground clearance limit mark under similar wind conditions. Following the sessions, a post-flight questionnaire will be given to the subject to collect data on pilot experience and pilot comfort level with each of the parking procedures.

3. FACILITIES AND INSTRUMENTATION.

3.1 TEST AIRCRAFT.

A Bell UH-1H will be used at the Technical Center for the night parking area tests.

3.1.1 Bell UH-1H.

The UH-1H to be used in this test has been assigned to, and maintained, by the Department of the Army, U.S. Army Communications and Electronics Command (CECOM), Ft. Monmouth, N.J., and is on loan to the FAA through an Interagency Agreement. It is a single engine helicopter equipped with electromechanical displays representative of civil instrument flight rules (IFR) certified helicopters. The aircraft was designed to carry up to 14 passengers and a pilot, is capable of speeds up to 120 knots, and has a rotor diameter of 48 feet. The UH-1H has a maximum takeoff weight of 9,500 pounds.

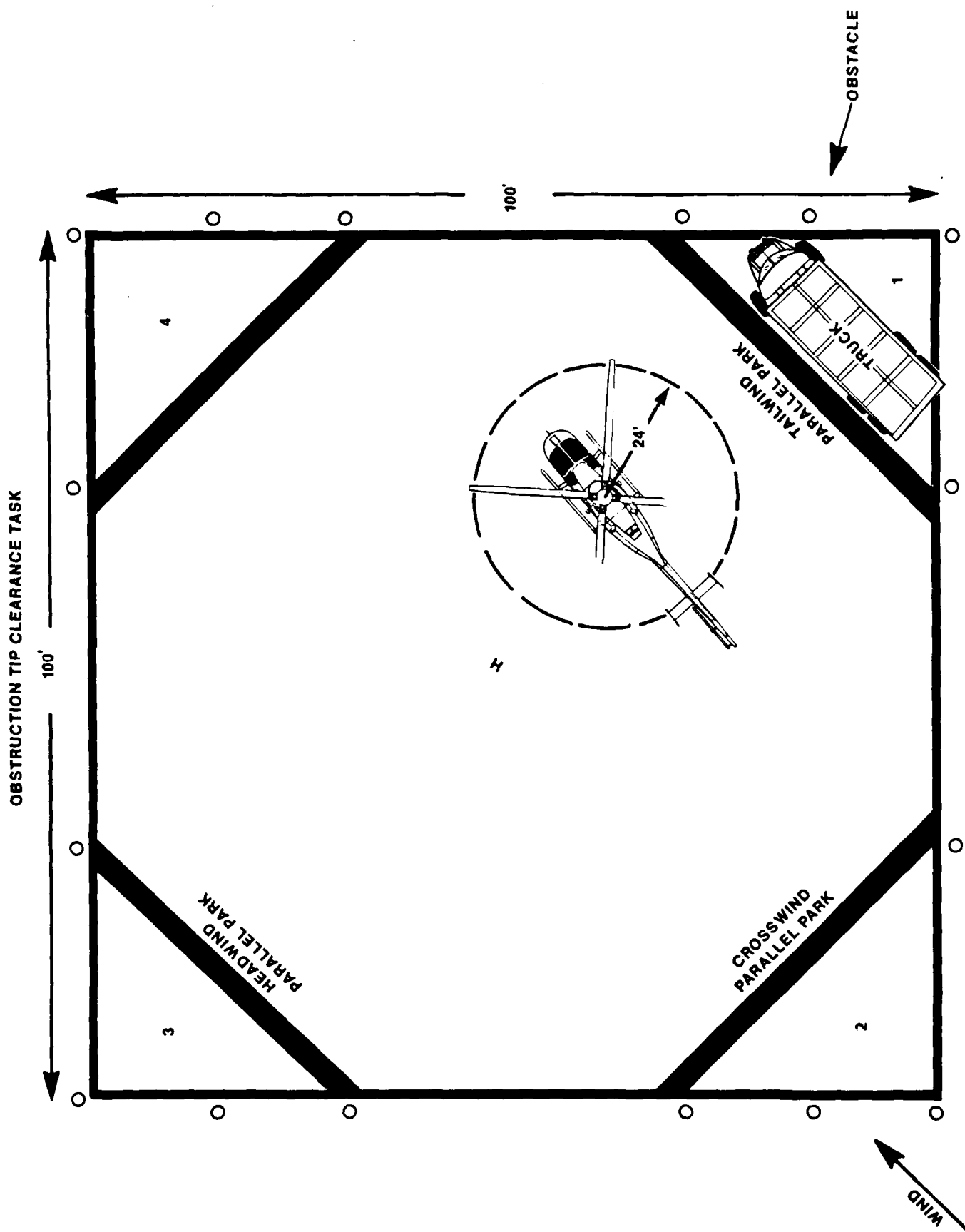


FIGURE 1. HELIPORT PARKING TESTS LAYOUT

3.2 GROUND TRACKING.

Once the aircraft is positioned following each parking maneuver, two markers will be placed at the edge of the aircraft's skids. The distances from two corners of the helipad to the midpoint between the two markers will be measured. This midpoint will be considered to be the location of the aircraft's mast. Using simple geometric procedures, the X and Y coordinates of that point will be calculated. With these coordinates, it will be possible to calculate the shortest distance from the mast to either the obstacle or the ground marking. The tip clearance will be computed by subtracting the rotor radius from that distance.

3.3 HELIPAD ILLUMINATION.

Existing helipad perimeter edge lamps will be used to the fullest extent possible.

Portable beacons will also be used to light the obstacle. The operational area illumination will be monitored throughout the flight tests by a calibrated light meter.

4. TESTING AND DATA COLLECTION.

4.1 SUBJECT PILOT SELECTION.

UH-1H pilots from the Technical Center will be asked to maneuver the helicopter at the Technical Center's National Concept and Development Heliport. Other pilots will also be recruited from the Avionic Research and Experimental Activities Center, Fort Monmouth, N.J., and from private sectors.

4.2 DATA COLLECTION MANEUVERS.

All tests will be conducted under night, low ambient light conditions. Subject pilots will be asked to park their helicopter next to a truck positioned at the corner of the pad. The truck will be repositioned so the pilot must maneuver the aircraft under headwind, tailwind, and crosswind conditions. In addition, the pilot will be requested to park the aircraft using only a ground mark as a reference. For the first nine parking maneuvers, the pilot will be told to park the helicopter at a position he feels is a safe distance from: (a) the truck and (b) from the ground marking. Prior to parking, the pilot will state how close he plans to get to the obstacle. During the second set of maneuvers the pilot will be told to position the aircraft so the rotor tip is 12 feet from the object or marking (see figure 2).

Approximately 25 hours of flight time will be required.

4.3 DATA RECORDING AND COLLECTION.

Data will be collected to determine the precision with which pilots are able to position the UH-1H relative to the intended position during the night parking operations. This requires:

- a. Determination of the helicopter position relative to the marked line or object.

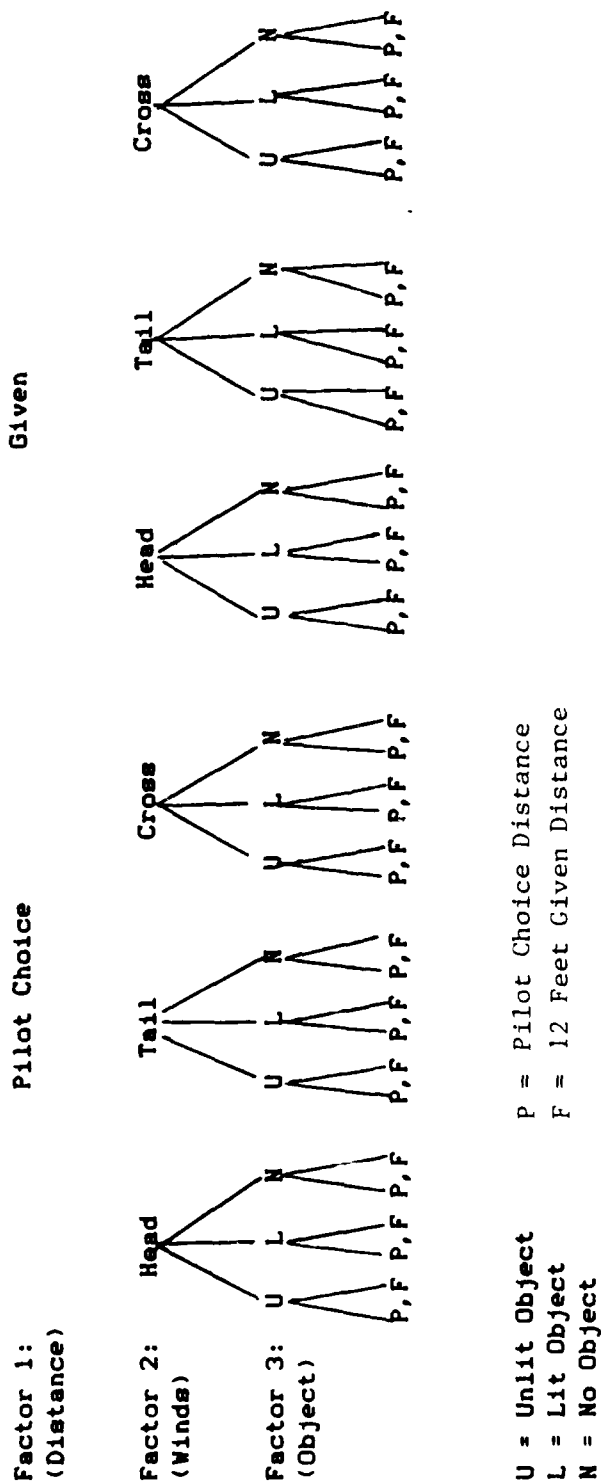


FIGURE 2. NIGHT PARKING TEST DESIGN

b. Knowledge of the intended parking position during the night parking operation.

This data will be determined from the following sources:

- a. Measurements taken by ground personnel at the heliport.
- b. Observer log/comments.

4.3.1 Preflight Briefing.

During the preflight briefing the subject pilot will be presented with an overview of the flight tests objectives and an outline of the flight maneuvers to be flown.

4.3.2 Observer Responsibilities.

The flight test observer will be responsible for filling in the Observer Log during each parking maneuver. Windspeed and direction for each maneuver, pilot name, and date of each test will be recorded. In addition, the observer will make notes about equipment problems and record any pilot comments.

4.3.3 Wind and Barometric Pressure.

Automated Weather Observing System (AWOS) wind speed and direction and barometric pressure information will be recorded during each night parking operation. This information will be examined to determine wind effect on pilot perception and performance during night parking operations at the helipad surface.

5. DATA REDUCTION AND ANALYSIS.

5.1 DATA REDUCTION.

All measurements will be entered on a personal computer (PC). The data will be grouped by wind conditions and calculations of the rotortip clearances from the marked line or obstacle will be made. All wind and barometric pressure information will be entered into the PC and referenced to its particular separation data.

Two types of errors will be computed: perception error and performance error. The perception error will be calculated by comparing the actual rotortip clearance (as determined from the computations performed on the ground measurements) to the pilot's estimated clearance. The performance error will be computed by comparing the actual tip clearance to the 12-foot requested clearance.

5.2 GRAPHICAL PRESENTATION.

Plots will be made of the perception and performance errors partitioned by wind conditions. Plots will also be produced for these errors regardless of winds. Lotus 1-2-3 software for a PC will be used to develop these plots.

5.3 STATISTICAL ANALYSIS.

Means and standard deviations will be calculated for: pilot stated tip clearances, perception errors, and performance error.

5.4 REPORTS.

Technical Center personnel will write a final Technical Note. This report will address the test objectives and contain pilot comments on each night parking operation as well as computed statistical data from these flight tests.

6. SCHEDULE.

Figure 3 describes the projected time each phase of this project will require for completion. The following factors may have an impact on this schedule:

- a. Weather.
- b. Aircraft availability at the Technical Center.
- c. Subject pilot availability at the Technical Center.

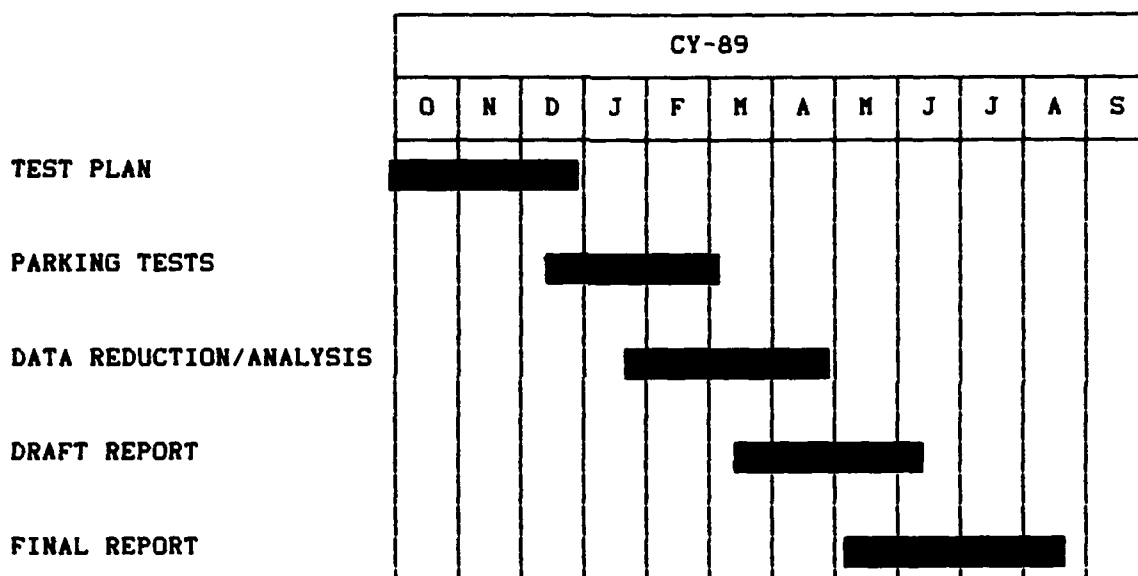


FIGURE 3. PROJECT SCHEDULE